Card Reference

This chapter describes the Cisco ONS 15310-CL and Cisco ONS 15310-MA cards. It includes descriptions and block diagrams for each card. For specifications, see Appendix A, "Specifications."For card installation and turn-up procedures, refer to the *Cisco ONS 15310-CL and Cisco ONS 15310-MA Procedure Guide*.

Chapter topics include:

Note The I-Temp symbol is located on the faceplate of an I-Temp compliant card. A card without this symbol is C-Temp compliant.

3.1 Card Summary and Compatibility

The Cisco ONS 15310-CL uses a common-control card (the 15310-CL-CTX), an interconnect card, a connector expansion card, and a traffic expansion card (either the CE-100T-8 or ML-100T-8 Ethernet card). The 15310-CL-CTX card provides optical and electrical connections for the ONS 15310-CL.

The Cisco ONS 15310-MA uses a common-control card (the CTX2500) and a combination of Ethernet cards (CE-100T-8 and ML-100T-8) and electrical cards (DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3). The CTX2500 card provides optical connections for the ONS 15310-MA.

This section provides a card summary. Figure 3-1 shows the ONS 15310-CL with an expansion card being inserted.

Figure 3-1 ONS 15310-CL with Expansion Card Being Inserted

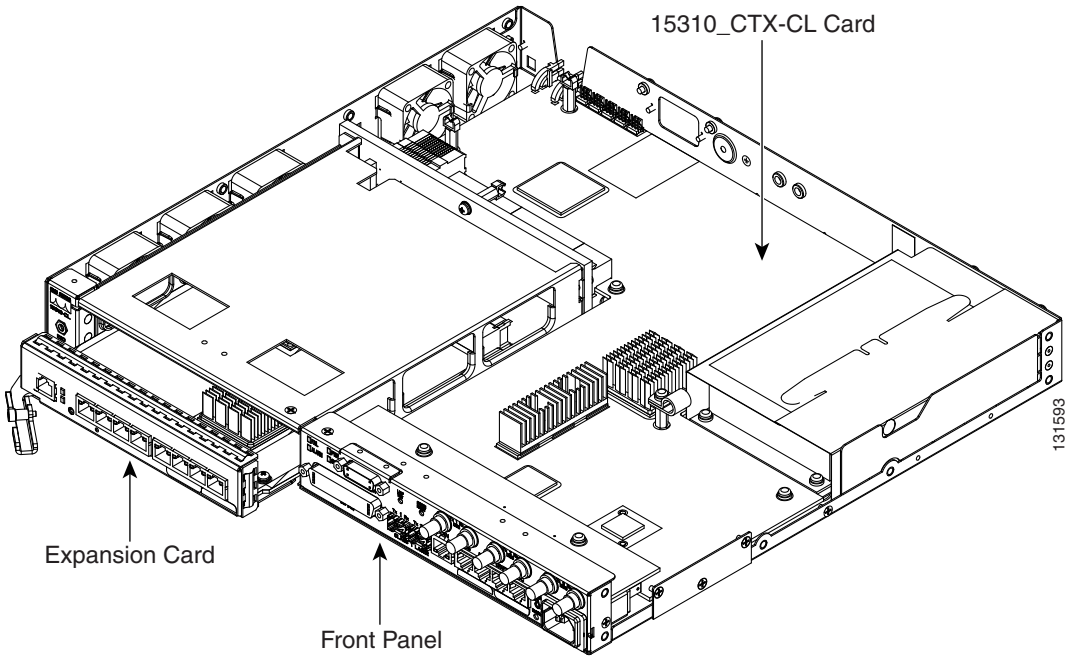
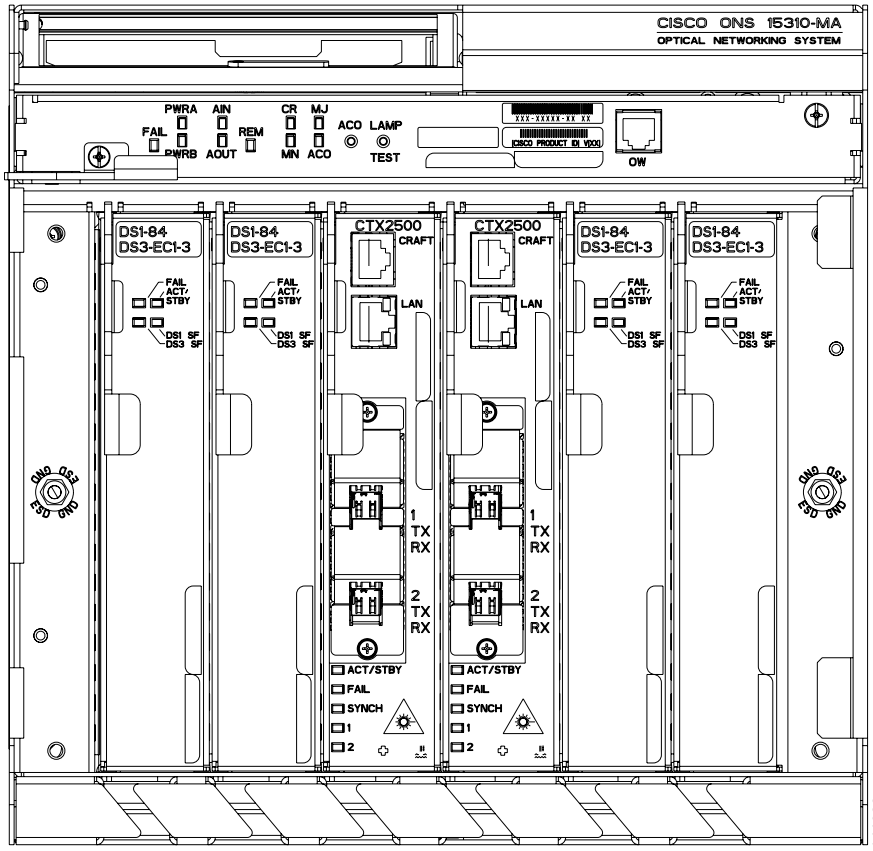


Figure 3-2 shows the ONS 15310-MA fully populated with cards.

Figure 3-2 ONS 15310-MA with Cards Installed



3.1.1 Card Summary

Table 3-1 ONS 15310-CL and ONS 15310-MA Cards and Descriptions

Card	Compatible Platform(s)	Description	For Additional Information...
15310-CL-CTX	CL only	The 15310-CL-CTX card serves as the common control and central switching element for the ONS 15310-CL.	See the "3.2 15310-CL-CTX Card" section on page 3-5.
CTX2500	MA only	The CTX2500 card serves as the common control and central switching element for the ONS 15310-MA.	See the "3.3 CTX2500 Card" section on page 3-8.
CE-100T-8	MA and CL	The CE-100T-8 card provides eight RJ-45 10/100-Mbps Ethernet ports.	See the "3.4 CE-100T-8 Card" section on page 3-10.
ML-100T-8	MA and CL	The ML-100T-8 Ethernet card provides eight ports of 10/100 Ethernet-encapsulated traffic into SONET/SDH STS-3/STM-1 payloads.	See the "3.5 ML-100T-8 Card" section on page 3-14.

Table 3-1 ONS 15310-CL and ONS 15310-MA Cards and Descriptions (continued)

Card	Compatible Platform(s)	Description	For Additional Information...
DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3	MA only	The DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 cards provide 28 and 84 Telcordia-compliant DS-1 ports, respectively, as well as three DS-3/EC-1 ports.	See the "3.6 DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 Cards" section on page 3-18.
Filler Card (Traffic Slot)	MA and CL	The FILLER card is used to fill unused traffic card slots in the ONS 15310-CL and ONS 15310-MA shelves. The Cisco Transport Controller (CTC) graphical user interface (GUI) detects the filler card.	See the "3.7 Filler Cards" section on page 3-19.
Filler Card (CTX2500 Slot)	MA only	The CTX FILLER card is used to fill unused CTX2500 card slots in the ONS 15310-MA shelf. CTC detects the filler card.	See the "3.7 Filler Cards" section on page 3-19.
SFP Modules	MA and CL	Small Form-factor Pluggables (SFPs) are integrated fiber-optic transceivers that provide high-speed serial links from a port or slot to the network.	See the "3.8 SFP Modules" section on page 3-20

3.1.2 Card Compatibility

Table 3-2 lists CTC software release compatibility for each ONS 15310-CL and ONS 15310-MA card. In the table, "Yes" means that the card is compatible with the listed software release.

Table 3-2 ONS 15310-CL and ONS 15310-MA Software Release Compatibility Per Card

Card	R5.0	R6.0	R7.0
15310-CL-CTX (ONS 15310-CL Only)	Yes	Yes	Yes
CTX2500 (ONS 15310-MA Only)	No	No	Yes
CE-100T-8 Card[1]	Yes	Yes	Yes
ML-100T-8 Card[2]	Yes	Yes	Yes
DS1-28/DS3-3 (ONS 15310-MA Only)	No	No	Yes
DS1-84/DS3-3 (ONS 15310-MA Only)	No	No	Yes
FILLER Card	Yes	Yes	Yes
CTX FILLER Card (ONS 15310-MA Only)	No	No	Yes

1. The CE-100T-8 card with product ID (PID) 15310-CE-100T-8 is not compatible with the ONS 15310-MA. 15310-P-CE-100T-8 is compatible with both the ONS 15310-MA and ONS 15310-CL shelf assemblies.
2. The ML-100T-8 card with PID 15310-ML-100T-8 is not compatible with the ONS 15310-MA shelf assembly. 15310-P-ML-100T-8 is compatible with both the ONS 15310-MA and ONS 15310-CL shelf assemblies.

3.2 15310-CL-CTX Card

This section describes the features and functions of the ONS 15310-CL Common Control, Timing, Cross-Connect Customer-Located (15310-CL-CTX) card.

The 15310-CL-CTX card is an internal, nonremovable card residing in the ONS 15310-CL platform. It operates in a nonredundant configuration and performs system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection/resolution, SONET data communications channel (DCC) termination, system fault detection, and cross-connect maintenance and management for the ONS 15310-CL. The card also provides the circuitry for the DS-1, DS-3/EC-1, and OC-3/OC-12 interfaces and ensures that the system maintains timing with SMC stability.

The 15310-CL-CTX card connects to an expansion card (CE-100T-8 or ML-100T-8) through a mechanical interconnect card within the ONS 15310-CL chassis that is similar to a backplane in appearance. The ONS 15310-CL provides a front chassis opening that accepts either a filler card, a CE-100T-8 plug-in card, or an ML-100T-8 plug-in card. When a card is plugged in, it connects to the 15310-CL-CTX card through the interconnect card.

The 15310-CL-CTX has three sets of ports:

- Wideband electrical (WBE) ports
- Broadband electrical (BBE) ports
- Optical pluggable port module (PPM) ports; PPM is the graphical user interface term for SFPs

See the "3.2.6 Electrical Interface (BBE and WBE)" section on page 3-8 and the "3.2.4 15310-CL-CTX Optical Interfaces" section on page 3-7 for more information.

The 15310-CL-CTX card does not have a faceplate because it is located inside the chassis; however, the 15310-CL-CTX LED indicators and connectors are located on the ONS 15310-CL front panel (Figure 3-3).

Figure 3-3 ONS 15310-CL Front Panel

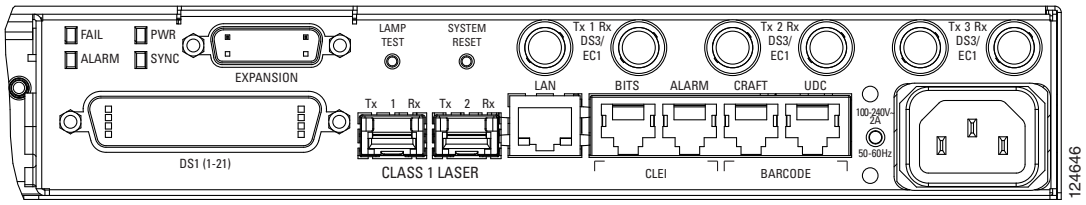
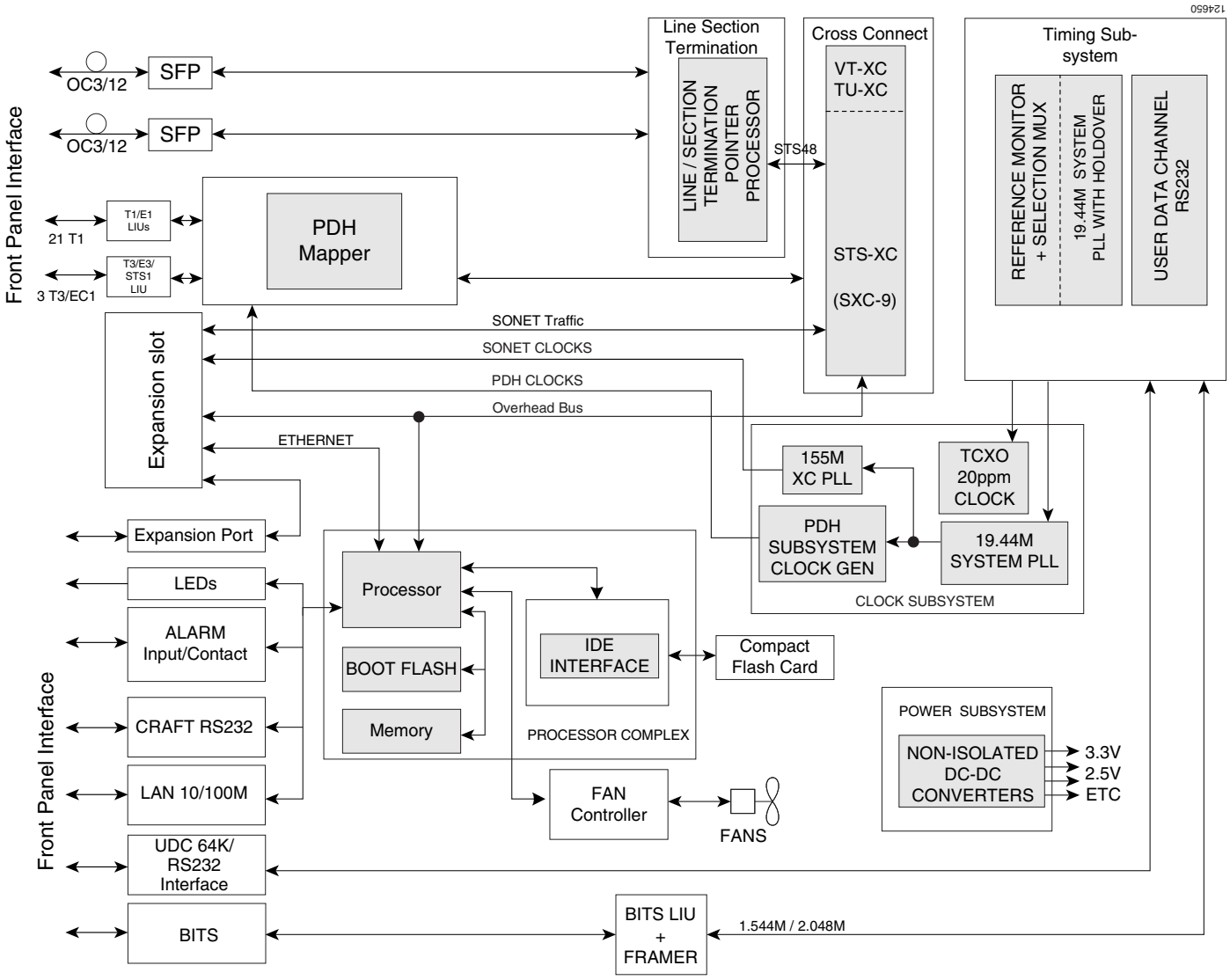


Figure 3-4 shows a functional block diagram of the 15310-CL-CTX card.

Figure 3-4 15310-CL-CTX Block Diagram



3.2.1 Features

The 15310-CL-CTX card has the following features:

- Support for a maximum of 21 bidirectional DS-1 and three DS-3/EC-1 ports
- Support for two SFP/LC optical interfaces for OC-3/OC-12
- 10/100BaseT LAN interface for CTC software
- 57.6-K maximum baud rate EIA/TIA-232 craft interface for Transaction Language One (TL1)
- Configurable alarm inputs and outputs (three input alarms and two alarm output contacts)

- One building integrated timing supply (BITS) input and one BITS output
- User data channel (UDC) connector for synchronous 64-Kbps or asynchronous EIA/TIA-232 communication
- Free-running SMC clock accurate to 20 ppm
- Timing reference to external BITS, optical links, or DS-1/EC-1 ports
- Retime any DS-1/EC-1 port, or use the ports as a timing source
- Nonblocking high-order STS1 cross-connect
- STS-48 worth of low-order cross-connect
- STS-24 worth of low-order VT1.5 cross-connect

3.2.2 Synchronization and Timing

This synchronization and timing subsystem is responsible for monitoring and selecting reference clocks in the node. A free-running SMC clock, accurate to 20 ppm, is available for internal synchronization in the event that no synchronization timing source is available. The 15310-CL-CTX card is normally synchronized from the optical link.

3.2.3 System Cross-Connect

This subsystem is responsible for the set up and maintenance of cross-connections within the system. It supports STS-Nc, STS-1, and VT1.5 cross-connect capability in SONET mode.

3.2.4 15310-CL-CTX Optical Interfaces

The optical subsystem provides two SFP optical transceivers for two OC-3/OC-12 SONET-compliant interfaces. SFPs attach to the ONS 15310-CL front panel via two SFP (PPM) slots. Each slot can contain a single-rate (OC-3 or OC-12) or multirate (OC-3 and OC-12) PPM.

Note PPM is the graphical user interface term for SFPs.

Single-rate PPMs are autoprovisioned when they are installed, but multirate PPMs must be provisioned. This behavior can be controlled by NE defaults.

To provision, edit, or delete PPM ports, refer to the "Change Port Settings" chapter in the *Cisco ONS 15310-CL and Cisco ONS 15310-MA Procedure Guide*. For more information about PPMs, see the "3.8 SFP Modules" section on page 3-20.

3.2.5 Communication and Control

This subsystem is responsible for overall control of the system, such as system initialization, provisioning, alarm reporting, maintenance, diagnostics, intercard communication, DCC termination, and system fault detection.

3.2.6 Electrical Interface (BBE and WBE)

This subsystem supports Telcordia GR-499 compliant, 1.544-Mbps (DS-1) and 44.736-Mbps (DS-3/EC-1) interfaces. Performance monitoring (PM) is provided by means of this interface to allow validation of signal quality. There are three DS-3 or EC-1 (BBE) ports located on the ONS 15310-CL front panel. BBE ports are automatically provisioned as DS-3 ports via network element (NE) defaults, but can be provisioned as EC-1 ports. See Appendix C, "Network Element Defaults Description" for more information. BBE ports support provisioning, configuration, creation, and deletion via CTC.

Any outgoing DS-1 signal can be retimed to eliminate accumulated jitter and wander at the point of egress from a synchronous network. Any incoming DS-1 signal from the transport element can also be used as timing source. There are 21 DS-1 (WBE) ports available at the LFH 96-pin connector on the ONS 15310-CL front panel. WBE ports are automatically provisioned and cannot be deleted or changed.

3.2.7 15310-CL-CTX Card-Level Indicators

The 15310-CL-CTX card is responsible for operating the LED indicators on the ONS 15310-CL front panel. The panel has four card-level LEDs, described in Table 3-3.

Table 3-3 15310-CL-CTX Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the 15310-CL-CTX card. As part of the boot sequence, the FAIL LED turns on and flashes until the software deems the card operational.
ALARM LED (Red/Amber)	The ALARM LED is red for Critical and Major alarm conditions. It is amber for Minor alarm conditions.
PWR LED (Green/Amber)	The PWR LED is green if AC power is connected and operating or if both DC power sources are connected and operating. The LED is amber if only one DC power source is connected and operating.
SYNC LED (Green/Amber/Red)	The SYNC LED is green if the 15310-CL-CTX card detects both a primary and secondary clock reference. It is amber if the card detects only a single clock reference. The LED is RED if the card detects no clock reference.

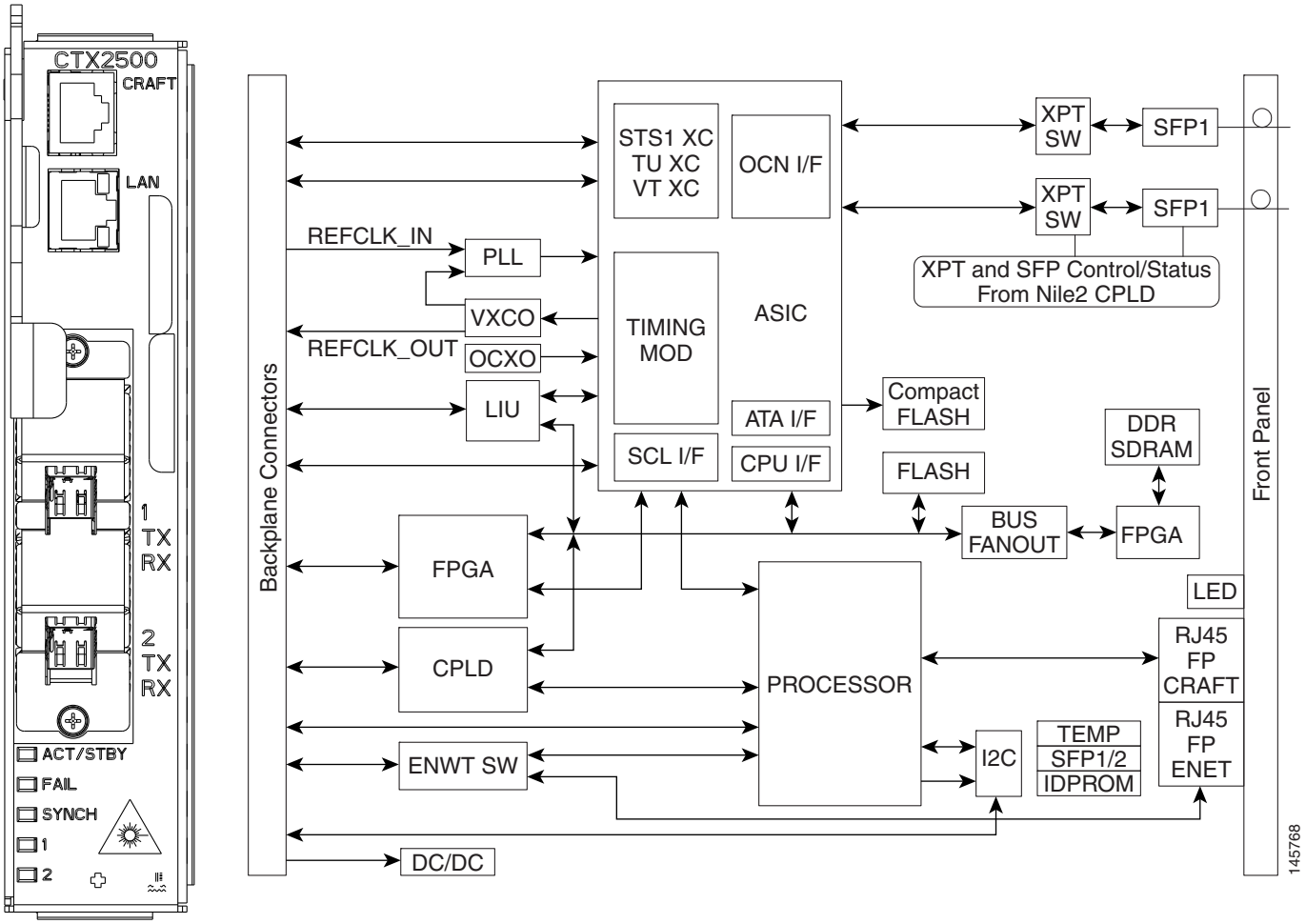
3.3 CTX2500 Card

The CTX2500 card, for use with the ONS 15310-MA, is a fully nonblocking cross-connect card that operates in either a simplex or duplex (redundant) configuration. It performs system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection/resolution, SONET DCC termination, system fault detection, and cross-connect maintenance and management for the ONS 15310-MA. The card also provides the circuitry for the OC-3/OC-12/OC-48 interfaces, and ensures that the system maintains timing with SMC stability.

Caution If the system loses power or the CTX2500 card is reset, you must reset the ONS 15310-MA clock unless the node has been previously provisioned to use Simple Network Time Protocol (SNTP) to update the clock over the LAN.

Figure 3-5 shows the CTX2500 card faceplate and block diagram.

Figure 3-5 CTX2500 Faceplate and Block Diagram



3.3.1 System Cross-Connect

The CTX2500 card provides 576 x 576 STS-1 level cross-connections and 2688 x 2688 VT1.5s.

3.3.2 CTX2500 Card Side Switches

The CTX2500 supports errorless side switches (less than a 50-ms impact to any traffic) when the switch is initiated through software, through either a soft-reset or a software upgrade where there is no FPGA or firmware upgrade. A side switch means switching from a CTX2500 on one side of the shelf to the redundant CTX2500 on the other side of the shelf.

3.3.3 CTX2500 Optical Interfaces

There are two PPM (SFP) slots on the CTX2500 faceplate to provide optical interfaces. (PPM is the graphical user interface term for SFP.) Each slot can contain a one-port PPM. Cisco-qualified PPMs can be single-rate (OC-3, OC-12, or OC-48) or multirate (OC-3/OC-12). Single-rate PPMs are autoprovisioned when they are installed, but multirate PPMs must be provisioned. This behavior can be controlled by NE defaults.

Note To provision, edit, or delete PPM ports, refer to the "Change Port Settings" chapter in the *Cisco ONS 15310-CL and Cisco ONS 15310-MA Procedure Guide*. For more information about PPM/SFP hardware, see the "3.8 SFP Modules" section on page 3-20.

3.3.4 CTX2500 Card-Level Indicators

The CTX2500 card has four card-level LEDs, described in Table 3-3.

Table 3-4 CTX2500 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the card. As part of the boot sequence, the FAIL LED turns on and flashes until the software deems the card operational.
ACT/STBY LED (Green/Amber)	The ACT/STBY LED is green if the card is the active CTX2500 card. It is amber if the card is the standby card.
SYNC LED (Green/Amber)	The SYNC LED is green if the CTX2500 card detects both a primary and secondary clock reference. It is amber if the card detects only a single clock reference.

3.3.5 CTX2500 Port-Level Indicators

Two bicolor LEDs show the status per port (Ports 1 and 2). The port LED is green if the port is available to carry traffic and is provisioned as in-service. The port LED is red if there is a signal failure or loss of signal on the port.

3.4 CE-100T-8 Card

This section describes the features and functions of the Layer 1 Ethernet card, the CE-100T-8. This card is compatible with both the ONS 15310-CL and the ONS 15310-MA.

Note The CE-100T-8 card with PID 15310-CE-100T-8 is not compatible with the ONS 15310-MA. The 15310-P-CE-100T-8 is compatible with both the ONS 15310-MA and ONS 15310-CL shelf assemblies. If you install a 15310-CE-100T-8 in an ONS 15310-MA shelf assembly, you will receive a mismatched equipment alarm (MEA). You can view the PID under the node view Inventory tab in CTC.

The CE-100T-8 card maps 8-port 10/100-Mbps Ethernet-encapsulated traffic into SONET payloads, making use of low-order (VT1.5) virtual concatenation (VCAT), high-order (STS-1, STS-3c) VCAT, generic framing procedure (GFP), and Point-to-Point Protocol/high-level data link control (PPP/HDLC) framing protocols. It also supports the link capacity adjustment scheme (LCAS), which allows hitless dynamic adjustment of SONET link bandwidth. The CE-100T-8 card provides eight RJ-45 10/100-Mbps Ethernet ports on the faceplate of the card. An inactive RJ-11 console port is also on the faceplate.

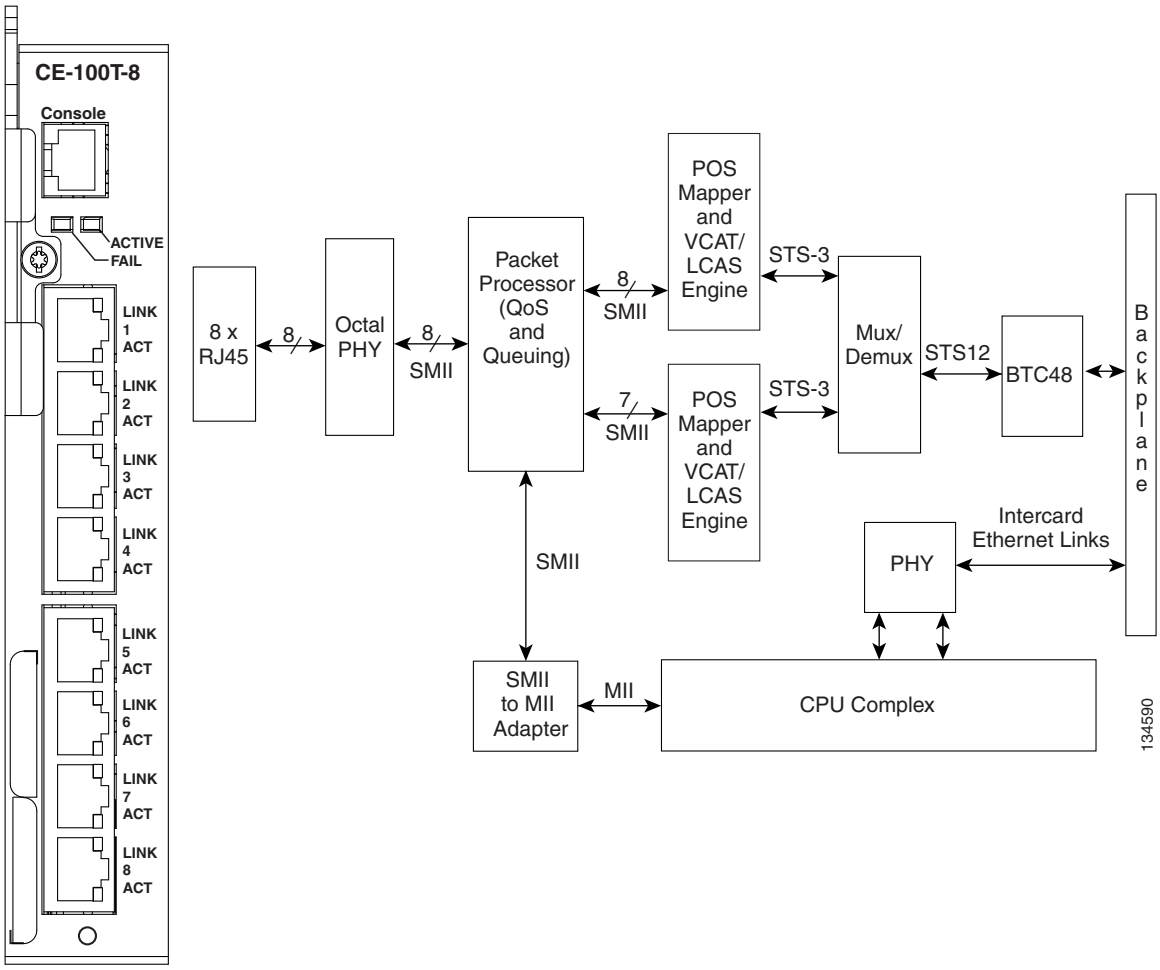
The circuit types supported are:

- STS-1 and STS-3c CCAT
- STS-1-Nv VCAT (N = 1–3)
- STS-1-Nv LCAS (N = 1–3)
- STS-1-2v software LCAS (SW-LCAS) (compatible with ML-Series cards only)
- VT1.5-Nv VCAT (N = 1–64)
- VT1.5-Nv LCAS (N = 1–64)

Each 10/100 Ethernet port can be mapped to a SONET channel in increments of VT1.5 or STS-1 granularity. There are eight backend packet-over-SONET (POS) ports (VCAT groups [VCGs]) available on the ML-100T-8 card. Additionally, the CE-100T-8 card supports packet processing, classification, quality of service (QoS)-based queuing, and traffic scheduling.

Figure 3-6 shows the CE-100T-8 card faceplate and block diagram.

Figure 3-6 CE-100T-8 Faceplate and Block Diagram



The following paragraphs describe the general functions of the CE-100T-8 card and relate it to the block diagram in Figure 3-6.

In the ingress direction (Ethernet-to-SONET), an octal PHY, which performs all of the physical layer interface functions for 10/100-Mbps Ethernet, sends the frame to the packet processor for queuing in the respective packet buffer memory. The packet processor performs packet processing, packet switching, and classification. The Ethernet frames are then passed over SMII channels to the POS mappers, where Ethernet traffic is terminated and is encapsulated using the PPP/HDLC or GFP framing protocols. The encapsulation method is selected on a per-port basis. The encapsulated Ethernet frames are then mapped into a configurable number of VCAT low-order and high-order payloads, such as VT1.5 synchronous payload envelope (SPE), STS-1 SPE, or a contiguous concatenated (CCAT) payload such as STS-3c SPE. Up to 64 VT1.5 SPEs or three STS-1 SPEs can be virtually concatenated.

The SPE from each POS mapper (up to STS-3) carrying encapsulated Ethernet frames are passed onto the multiplexer/demultiplexer (mux/demux) next, where the STS-3 frames from both POS mappers are multiplexed to form an STS-12 frame for transport over the SONET network by means of the Bridging Transmission Convergence (BTC-48) application-specific integrated circuit (ASIC).

Note Although the STS-3 frames are multiplexed into an STS-12 frame, the frame carries at most an STS-6 payload, leaving half of the STS-12 bandwidth free.

In the egress direction (SONET-to-Ethernet), the mux/demux extracts the first and second STS-3 SPEs from the STS-12 frame it receives from the BTC-48 before sending them to the POS mappers. The STS-3 SONET SPE carrying GFP or PPP/HDLC encapsulated Ethernet frames are then extracted and buffered in the external memory of the POS mappers. This memory is used for providing alignment and differential delay compensation for the received low/high order virtual concatenated payloads. When alignment and delay compensation are complete, the Ethernet frames are decapsulated with one of the framing protocols (GFP or PPP/HDLC). Decapsulated Ethernet frames are then passed onto the packet processor for QoS queuing and traffic scheduling. The network processor switches the frame to one of the corresponding PHY channels and then onto the Ethernet port for transmission to the external clients.

With regard to QoS, the VLAN class-of-service (CoS) threshold (value 0 to 7, default 7) and the IP type-of-service (ToS) threshold (value 0 to 255, default 255) on incoming Ethernet packets are both available for priority queuing. These thresholds are provisionable through CTC, TL1, and Cisco Transport Manager (CTM). CoS takes precedence over ToS unless the CoS threshold is set to the default of 7. This threshold value does not prioritize any packets based on CoS, so ToS is used. The value configured is a threshold and any value greater than that value is set as a priority. For example, if a CoS of 5 is set as the threshold, only CoS values of 6 and 7 would be set to priority.

3.4.1 CE-100T-8 Card-Level Indicators

The CE-100T-8 card faceplate has two card-level LED indicators, described in Table 3-5.

Table 3-5 CE-100T-8 Card-Level Indicators

Card-Level LEDs	Description
SF LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the CE-100T-8 card. As part of the boot sequence, the FAIL LED blinks until the software deems the card operational, then it turns off.
ACT LED (Green)	The ACT LED provides the operational status of the CE-100T-8. When the ACT LED is green, it indicates that the CE-100T-8 card is active and the software is operational; otherwise, it is off.

3.4.2 CE-100T-8 Port-Level Indicators

The CE-100T-8 card has two LEDs embedded into each of the eight Ethernet-port RJ-45 connectors. The LEDs are described in Table 3-6.

Table 3-6 CE-100T-8 Port-Level Indicators

Port-Level Indicators	Description
ACT LED (Amber)	A steady amber LED indicates a link is detected, but there is an issue inhibiting traffic. A blinking amber LED means traffic is flowing.
LINK LED (Green)	A steady green LED indicates that a link is detected, but there is no traffic. A blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED OFF	Unlit green and amber LEDs indicate no traffic.

3.5 ML-100T-8 Card

This section describes the features and functions of the Layer 2 10/100 Ethernet card, the ML-100T-8. The card is compatible with both the ONS 15310-CL and the ONS 15310-MA.

Note The ML-100T-8 card with PID 15310-ML-100T-8 is not compatible with the ONS 15310-MA. 15310-P-ML-100T-8 is compatible with both the ONS 15310-MA and ONS 15310-CL shelf assemblies. If you install a 15310-ML-100T-8 in an ONS 15310-MA shelf assembly, you will receive a mismatched equipment alarm (MEA). You can view the PID under the node view Inventory tab in CTC.

3.5.1 ML-100T-8 Card Description

The ML-100T-8 card maps eight ports of 10/100 Ethernet encapsulated traffic into SONET STS-3 payloads. The card is compatible with high-order STS-1 VCAT and the GFP and PPP/HDLC framing protocols. It also supports LCAS, which allows hitless dynamic adjustment of SONET/SDH link bandwidth. Each 10/100 Ethernet port can be mapped to a SONET channel in increments of STS-1 granularity.

The ML-100T-8 card provides a switched operating mode, with eight subscriber interfaces and two virtual POS (VCG) interfaces mapped through the cross-connect for transport with other services between network elements (NEs).

The circuit types supported are:

- STS-1
- STS-1-Nv VCAT (N=1–2)
- STS-1-Nv LCAS (N=1–2)
- STS-1-2v SW-LCAS

Additionally, the ML-100T-8 card supports packet processing, classification, QoS-based queuing, traffic scheduling, and packet multiplexing services for Layer 2/3.

3.5.2 ML-Series Cisco IOS CLI Console Port

The ML-Series card has an RJ-11 serial console port on the card faceplate labeled Console. It enables communication from the serial port of a PC or workstation running terminal emulation software to the Cisco IOS command line interface (CLI) on a specific ML-Series card.

Due to space limitations on the ML-Series card faceplate, the console port is an RJ-11 modular jack instead of the more common RJ-45 modular jack. Cisco supplies an RJ-11 to RJ-45 console cable adapter with each ML-Series card. After connecting the adapter, the console port functions like the standard Cisco RJ-45 console port. Figure 3-7 shows the RJ-11-to-RJ-45 console cable adapter.

Figure 3-7 Console Cable Adapter

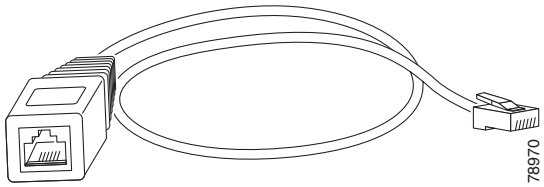
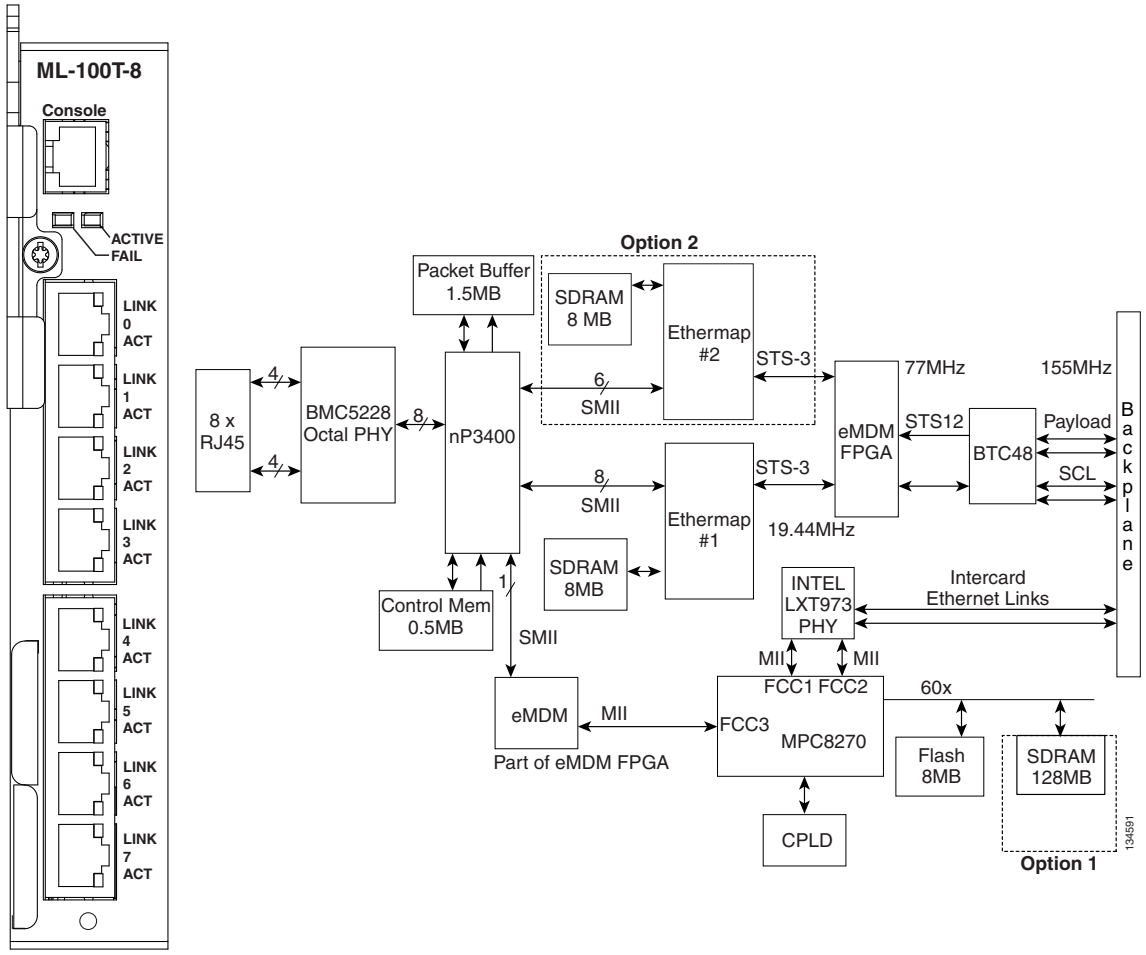


Figure 3-8 shows the ML-100T-8 card faceplate and block diagram.

Figure 3-8 ML-100T-8 Card Faceplate and Block Diagram



The following paragraphs describe the general functions of the ML-100T-8 card and relate to the block diagram in Figure 3-8.

In the ingress direction (Ethernet-to-SONET), Ethernet frames first enter from a physical Ethernet port to one of the corresponding channels of the octal PHY, which performs all of the physical layer interface functions for 10/100 Ethernet. The PHY sends the Ethernet frame to the packet processor by means of the SMII interfaces for queuing in the respective packet buffer memory. The packet processor performs packet processing, packet switching, and classification. The Ethernet frames are then passed on to the POS mappers through the SMII interfaces. The POS mappers terminate the 10/100-Mbps Ethernet traffic. The Ethernet frames are extracted and buffered in POS mapper external memory. Ethernet frames are encapsulated using one of the framing protocols (PPP/HDLC or GFP), selected on a per-port basis. The encapsulated Ethernet frames are mapped into a configurable number of STS-1 or VCAT high-order payloads (STS-1-1v or STS-1-2v). The SPE from each POS mapper (up to STS-3) carrying encapsulated Ethernet frames are next passed onto the mux/demux, where the STS-3 frames from both POS mappers are multiplexed to form an STS-12 frame for transport over the SONET network by means of the BTC-48 ASIC.

Note Although the STS-3 frames are multiplexed into an STS-12 frame, the frame carries at most an STS-6 payload, leaving half of the STS-12 bandwidth free.

In the egress direction (SONET-to-Ethernet), the mux/demux extracts the first and second STS-3 SPEs from the STS-12 frame it receives from the BTC-48 before sending it to the POS mapper. The STS-3 SONET SPEs carrying GFP or PPP/HDLC encapsulated Ethernet frames are then extracted and buffered in the POS mapper external memory. This memory is used for providing alignment and differential delay compensation for the received high-order VCAT payloads. After alignment and delay compensation have been done, the Ethernet frames are decapsulated with one of the framing protocols (GFP or PPP/HDLC). Decapsulated Ethernet frames are then passed onto the network processor for QoS queuing, traffic scheduling, packet switching, and multiplexing. The network processor switches the frame to one of the corresponding PHY channels and then onto the Ethernet port for transmission to the external clients.

3.5.3 ML-100T-8 Card-Level Indicators

The ML-100T-8 card faceplate has two card-level LED indicators, described in Table 3-7.

Table 3-7 ML-100T-8 Card-Level Indicators

Card-Level LEDs	Description
SF LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the CE-100T-8 card. As part of the boot sequence, the FAIL LED blinks until the software deems the card operational, then it turns off.
ACT LED (Green)	The ACT LED provides the operational status of the ML-100T-8. When the ACT LED is green, it indicates that the ML-100T-8 card is active and the software is operational; otherwise, it is off.

3.5.4 ML-100T-8 Port-Level Indicators

The ML-100T-8 card has two LEDs embedded into each of the eight Ethernet port RJ-45 connectors. The LEDs are described in Table 3-8.

Table 3-8 ML-100T-8 Port-Level Indicators

Port-Level Indicators	Description
ACT LED (Amber)	A steady amber LED indicates a link is detected, but there is an issue inhibiting traffic. A blinking amber LED means traffic is flowing.
LINK LED (Green)	A steady green LED indicates that a link is detected, but there is no traffic. A blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED OFF	Unlit LEDs indicate no traffic.

3.6 DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 Cards

Note For hardware specifications, see the "A.3.4 DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 Cards" section on page A-12.

The ONS 15310-MA DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 cards provide 28 or 84 Telcordia-compliant, GR-499 DS-1 ports per card, respectively, and three DS-3/EC-1 ports. Each DS-1 port operates at 1.544 Mbps. Each DS-3/EC-1 port operates at 44.736 Mbps over a single 75-ohm 728 A or equivalent coaxial span. These cards can operate as a working or protect card in 1:1 protection schemes.

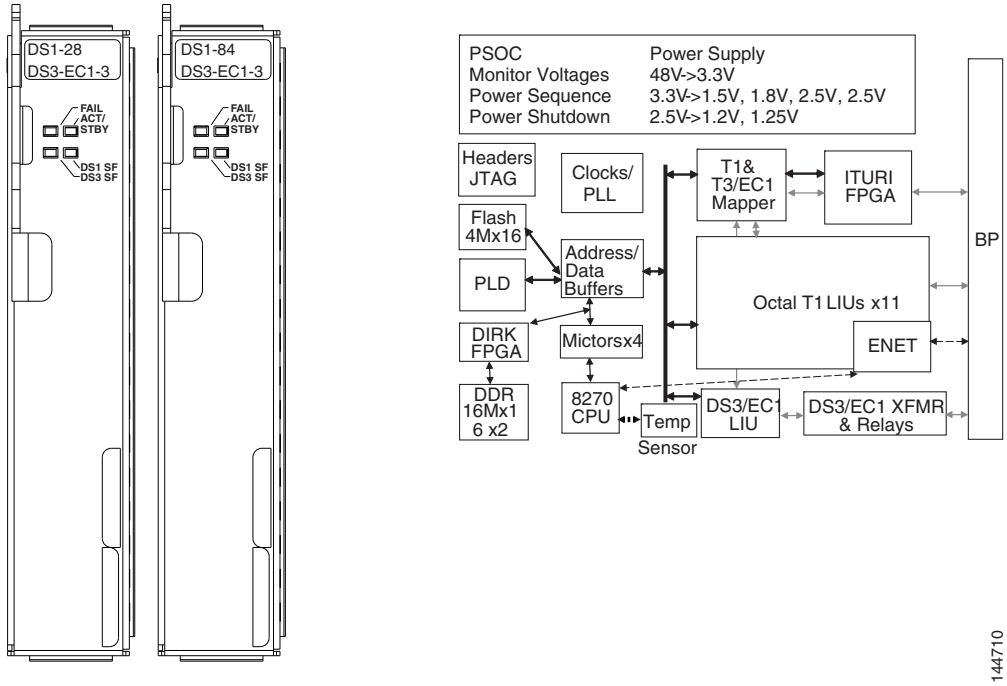
In addition, the DS1-28/DS3-EC1-3 card provides retiming, so that any outgoing DS-1 signal can be retimed to eliminate accumulated jitter and wander at the point of egress from a synchronous network. Any incoming DS-1 signal from the transport element can also be used as a timing source.

The DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 cards can be installed in Slots 1, 2, 5, and 6. Card installed in Slots 1 and 2 correspond with the electrical interface assembly (EIA) installed on Side A at the rear of the shelf assembly, and cards in Slots 5 and 6 correspond with the EIA installed on Side B.

See the "4.3.1 .1:1 Electrical Card Protection" section on page 4-2 for information about electrical card protection and supported shelf configurations.

Figure 3-9 shows the DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 card faceplates and block diagram.

Figure 3-9 DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 Card Faceplates and Block Diagram



3.6.1 DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 Card-Level Indicators

The DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 cards have three card-level LED indicators (Table 3-9).

Table 3-9 DS1-28/DS3-EC1-3 and DS1-84/DS3-EC1-3 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	Indicates that the card processor is not ready. This LED is on during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists in flashing.
ACT/STBY LED Green (Active) Amber (Standby)	When the ACT/STBY LED is green, the card is operational and ready to carry traffic. When the ACT/STBY LED is amber, the card is operational and in standby (protect) mode.
Amber DS1 and DS3 SF LEDs	Indicates a signal failure or condition such as LOS or LOF on one or more card ports.

3.7 Filler Cards

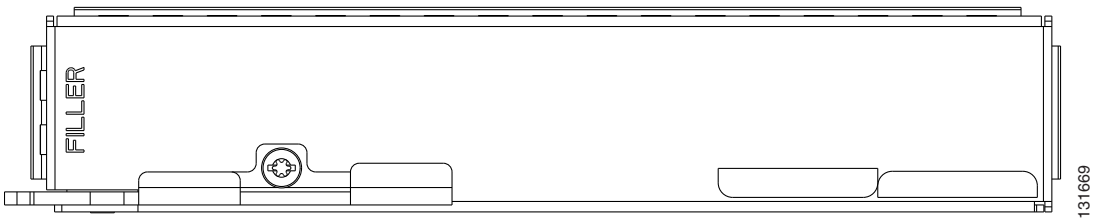
If a card slot is left empty, a filler card must be installed in the slot. The filler card serves three functions: it prevents exposure to hazardous voltages and currents inside the chassis, it eliminates electromagnetic interference (EMI) that might disrupt other equipment, and it directs the flow of cooling air through the chassis.

Caution Do not operate the ONS 15310-CL or ONS 15310-MA system unless a card is plugged into each card slot.

The blank card is a printed circuit board (PCB) with a blank faceplate and two rear connectors that plug into receptacles at the back of the slot. CTC detects when a filler card is plugged in and displays it in node view.

Figure 3-10 shows the filler card faceplate. This card is used in the ONS 15310-CL expansion slot and ONS 15310-MA traffic card slots.

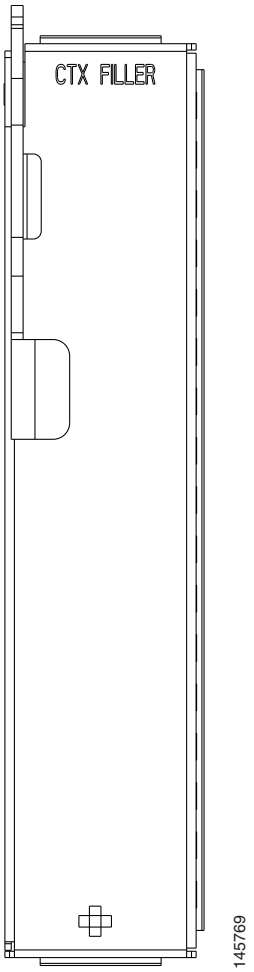
Figure 3-10 Filler Card



Caution Do not attempt to install the FILLER card in a CTX2500 card slot (Slots 3 and 4) on the 15310-MA shelf assembly. Only a CTX FILLER card should be installed in the CTX2500 slot.

Figure 3-11 shows the CTX2500 filler card faceplate for the ONS 15310-MA.

Figure 3-11 CTX2500 Filler Card



Caution Do not attempt to install the CTX FILLER card in a traffic card slot (Slots 1, 2, 5, and 6 in the ONS 15310-MA, and the expansion card slot in the ONS 15310-CL). Only 15310-EXP-FILLER cards should be installed in the traffic card slots.

3.8 SFP Modules

This section describes the small-form factor pluggables (SFPs) that can be used with the 15310-CL-CTX and CTX2500 cards to provide optical interfaces. The 15310-CL-CTX card does not have a faceplate because it is located inside the chassis; therefore, the two SFP slots are located on the ONS 15310-CL faceplate, just to the left of the LAN connector (see Figure 3-3 on page 3-5). The SFP slots for the ONS 15310-MA are located at the bottom of the CTX2500 card. Ethernet and electrical cards do not use SFPs.

3.8.1 Compatibility by Card

Table 3-10 lists the SFPs compatible with the 15310-CL-CTX and CTX2500 cards. For more information about SFPs, see the "A.4 SFP Specifications" section on page A-15.

Caution Only use SFPs certified for use in Cisco Optical Networking Systems (ONSs). The qualified Cisco SFP top assembly numbers (TANs) are provided in Table 3-10.

Table 3-10 SFP Card Compatibility

Card	Compatible SFP (Cisco Product ID)	Cisco Top Assembly Number (TAN)
15310-CL-CTX (ONS 15310-CL) and CTX2500 (ONS 15310-MA)	ONS-SI-155-L1 ONS-SI-155-L2 ONS-SI-155-I1 ONS-SI-622-L1 ONS-SI-622-L2 ONS-SI-622-I1	10-1957-01 10-1937-01 10-1938-01 10-1958-01 10-1936-01 10-1956-01
CTX2500 (ONS 15310-MA) only	ONS-SI-2G-I1 ONS-SI-2G-L1 ONS-SI-2G-S1 ONS-SI-2G-L2 ONS-SE-155-1470 ONS-SE-155-1490 ONS-SE-155-1510 ONS-SE-155-1530 ONS-SE-155-1550 ONS-SE-155-1570	10-1993-01 10-2102-01 10-1992-01 10-1990-01 10-1996-01 10-1998-01 10-1999-01 10-2000-01 10-2001-01 10-2002-01
	ONS-SE-155-1590 ONS-SE-155-1610 ONS-SE-622-1470 ONS-SE-622-1490 ONS-SE-622-1510 ONS-SE-622-1530 ONS-SE-622-1550 ONS-SE-622-1570 ONS-SE-622-1590 ONS-SE-622-1610	10-2003-01 10-1997-01 10-2004-01 10-2005-01 10-2006-01 10-2007-01 10-2008-01 10-2009-01 10-2010-01 10-2011-01
	ONS-SC-2G-30.3 ONS-SC-2G-31.1 ONS-SC-2G-31.9 ONS-SC-2G-32.6 ONS-SC-2G-34.2 ONS-SC-2G-35.0 ONS-SC-2G-35.8 ONS-SC-2G-36.6 ONS-SC-2G-38.1 ONS-SC-2G-38.9	10-2155-01 10-2156-01 10-2157-01 10-2158-01 10-2159-01 10-2160-01 10-2161-01 10-2162-01 10-2163-01 10-2164-01

Table 3-10 SFP Card Compatibility (continued)

Card	Compatible SFP (Cisco Product ID)	Cisco Top Assembly Number (TAN)
CTX2500 (ONS 15310-MA) only (continued)	ONS-SC-2G-39.7	10-2165-01
	ONS-SC-2G-40.5	10-2185-01
	ONS-SC-2G-42.1	10-2166-01
	ONS-SC-2G-42.9	10-2167-01
	ONS-SC-2G-43.7	10-2168-01
	ONS-SC-2G-44.5	10-2169-01
	ONS-SC-2G-46.1	10-2170-01
	ONS-SC-2G-46.9	10-2171-01
	ONS-SC-2G-47.7	10-2172-01
	ONS-SC-2G-48.5	10-2173-01
	ONS-SC-2G-50.1	10-2186-01
	ONS-SC-2G-50.9	10-2174-01
	ONS-SC-2G-51.7	10-2175-01
	ONS-SC-2G-52.5	10-2176-01
	ONS-SC-2G-54.1	10-2177-01
	ONS-SC-2G-54.9	10-2178-01
	ONS-SC-2G-55.7	10-2179-01
	ONS-SC-2G-56.5	10-2180-01
	ONS-SC-2G-58.1	10-2181-01
	ONS-SC-2G-58.9	10-2182-01
	ONS-SC-2G-59.7	10-2183-01
	ONS-SC-2G-60.6	10-2184-01

3.8.2 SFP Description

SFPs are integrated fiber-optic transceivers that provide high-speed serial links from a port or slot to the network. Various latching mechanisms can be utilized on the SFPs. There is no correlation between the type of latch to the model type (such as SX or LX/LH) or technology type (such as Gigabit Ethernet). See the label on the SFP for the technology type and model. One type of latch available is a mylar tab, shown in Figure 3-12. A second type of latch is an actuator/button (Figure 3-13), and a third type is a bail clasp (Figure 3-14).

SFP dimensions are:

- Height 0.03 in. (8.5 mm)
- Width 0.53 in. (13.4 mm)
- Depth 2.22 in. (56.5 mm)

SFP temperature ranges are:

- COM—Commercial operating temperature range –5 to 70 degrees C (23 to 158 degrees F)
- EXT—Extended operating temperature range –5 to 85 degrees C (23 to 185 degrees F)
- IND—Industrial operating temperature range –40 to 85 degrees C (–40 to 85 degrees F)

Figure 3-12 Mylar Tab SFP

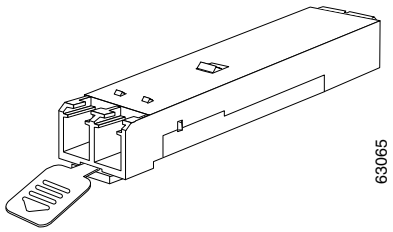


Figure 3-13 Actuator/Button SFP

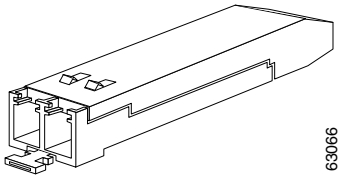
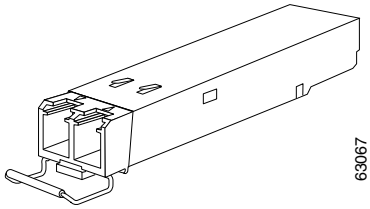


Figure 3-14 Bail Clasp SFP



3.8.3 PPM Provisioning

SFPs are known as pluggable port modules (PPMs) in CTC. PPMs provide OC-3 and OC-12 line rates for the ONS 15310-CL and they provide OC-3, OC-12, and OC-48 line rates for the ONS 15310-MA. See the "3.2.4 15310-CL-CTX Optical Interfaces" section on page 3-7 and the "3.3.3 CTX2500 Optical Interfaces" section on page 3-10 for more information. To provision PPMs, including provisioning or changing the optical line rate, refer to the *Cisco ONS 15310-CL and Cisco ONS 15310-MA Procedure Guide*.